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Functional Outcome of Extended Curettage and Reconstruction for Giant Cell Tumor around Knee

Nandlal Bharwani[1], Nirottam Singh[2], Shubham Agarwal[3], Dr. Hemant Jain[4], Dr. Kishore Raichandani[5], Dr. Medhavi Saxena[6]

[1]PG Resident

[2]Assistant Professor

[3]PG Resident

[4]Associate professor

[5]Senior Professor

[6]PG Resident

Abstract: ***Background: GCT Bone is the commonest benign bone tumor with female predominance and commonly seen around knee joint. Treatment of GCT can be done by curettage with reconstruction or wide resection. The aim of this study is to see functional outcome of extended curettage and reconstruction with bone cement or sandwich technique along with internal fixation. Method: A total of 9 females and 6 males aged between 20-50 years managed with extended curettage and reconstruction with bone cement(6) or sandwich technique(9). Along with internal fixation in all patients except two patients (small lesion less than 5cm^2) between January 2015 to December 2020 were taken. Extended curettage was done with the help of 5% phenol and high speed burr. Functional outcome was evaluated using Musculoskeletal tumor society score (MSTS). Results: The mean follow up period was 20.13 months (range 12-48 months). The mean MSTS score at final follow up was 25.27 out of 30. Age, sex did not have much effect on functional outcome of patients, whereas grade of tumor and technique had significant effect on functional outcome. In our study, two patients had superficial infection, four patients had restricted ROM, one patient had varus collapse and one patient had recurrence out of 15 patients. Conclusion: Extended intralesional curettage and reconstruction with bone cement or sandwich technique along with internal fixation had good functional outcome. Age, sex had no effect on functional outcome of patients, whereas grade of tumor, technique had effect on functional outcome in our study. A long duration of follow-up and large group of patients is required to comment on recurrence rates.***

Keywords: giant cell tumor, extended curettage, sandwich technique, msts, functional outcome

1. Introduction

Giant cell tumor (GCT) is amongst the commonest benign bone tumor encountered by orthopaedicians. GCT occurs in skeletally mature individuals with peak incidence around 3rd - 4th decade. GCT of bone has female predominance and commonly occurs around knee joint (distal femur> proximal tibia).

GCT is locally aggressive and undergoes recurrence and malignant transformation.[1]The treatment of GCT aims for complete removal of tumor, reconstruction of defect and restoration of function of limb. Treatment of GCT by curettage alone has high chances of recurrence,[2,3] so now days extended curettage is done with adjuvants like (chemical- 5%phenol, ethanol, hydrogen peroxide) and (thermal-argon, cryotherapy with liq.N_2,high speed burr) followed by reconstruction with bone cement or sandwich technique[4] along with internal fixation.

The following study conducted with the aim to evaluate success of treatment of GCT by extended curettage with help of adjutants (5%phenol,high speed burr) and reconstruction with bone cement or sandwich technique internal fixation done with cortico-cancellous screws or locking plates.

2. Materials and Methods

This was a retrospective observational study conducted in the department of Orthopaedics in a tertiary health care centre of western Rajasthan from January 2016 to December 2020. A total of 15 patients (9 females and 6 males) who underwent extended curettage and reconstruction with bone cement(6) or sandwich technique(9) and internal fixation for GCT of knee joint except 2 patients in which only bone cement was used as defect was small(less than 5 cm^2) (distal femur-9, proximal tibia-6) were included in the study. Patients demographics, contact details, grade of tumor, technique, preop x-ray and preop MSTS score were taken from bed head tickets.

All patients between age group 20-50 years (mean 29.07) both males and non pregnant females presenting with gct around knee were included. All patients were graded on the basis of AP and Lateral radiograph according to camapanacci grading.
GCT was classified according to Campanacci[4] grading system
Grade-1:- well defined margin with intact cortex (7 patients)
Grade-2:- relative well defined margin with no radio-opaque rim and thinned and moderate expanded cortex (5 patients)
Grade-3:- with indistinct border with cortical destruction (3 patients)

All the patients with pathological fractures were excluded from our study

Technique- - Under regional anaesthesia, incision was made to include scar of biopsy. Adequate exposure was done by making large cortical window and curettage was done till normal appearing bone seen. Then cavity was enlarged gradually with help of high speed burr and proper measures were taken to avoid contamination of surrounding tissue. Then in cavity 5% phenol soaked gauze was kept for 2 minutes, care was taken not to spill phenol in surrounding tissue followed by pulsatile lavage which helps to bare raw cancellous bone, then chips of cancellous iliac crest graft was placed in subchondral region with layer of gelfoam and then internal fixation and the cases in which defect was small filled with bone cement only without need of internal fixation. Finally cavity was filled with bone cement, closure of soft tissue was done and skin was closed in layers. All the patients were given above knee plasters for immobilization.

After 2 weeks knee bending and quadriceps strengthening exercises were started and non-weight bearing crutch walk started and partial weight bearing allowed as per tolerance after 1 month post-surgery. After 3 months full weight bearing was started.

Functional outcome was evaluated using Musculoskeletal tumor society score (MSTS)[5], having 6 parameters- pain, function, emotional acceptance, use of walking aids, walking ability and gait along with subjective clinical assessment.

Recurrence of tumor was defined as increased lysis of >5mm at bone cement interface or absence of sclerotic rim at bone cement interface.[5]

3. Results

The mean follow up was 20.13 months range (range 12 to 48 months). The functional (MSTS score) shown in table-1 and graph.

Table 1

Time	Mean±SD	Mean difference	t value	p value
Pre-op msts	13.33±1.35	-	-	-
3rd month msts	17.40±0.91	-4.067	19.71	<0.0001
6th month msts	21.53±1.25	-8.200	19.17	<0.0001
12th month msts	25.27±1.22	-11.93	27.09	<0.0001

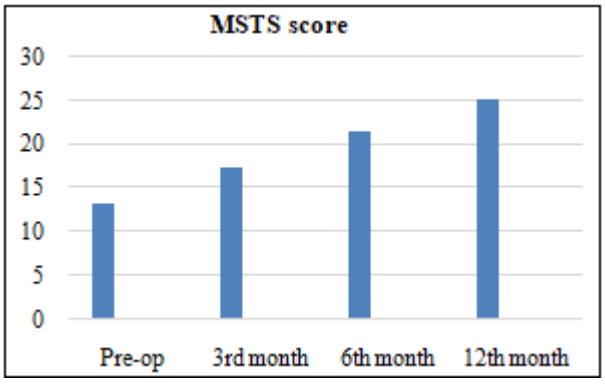


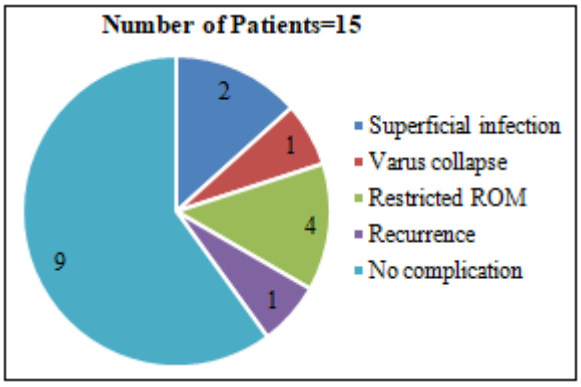
Table 2

Variables		No. of patients	Final MSTS Score		p value
			Mean	SD	
Age	≤30	9	25.44	1.13	0.593*
	>30	6	25.00	1.41	
Sex	Male	6	25.33	1.36	0.766*
	Female	9	25.22	1.20	
Grade of tumor	Grade 1	7	26.00	0.81	**0.035** (S)**
	Grade 2	5	25.00	1.22	
	Grade 3	3	24.00	1.00	
Technique	Bone cement	6	24.33	1.05	**0.020* (S)**
	Sandwich	9	25.88	0.81	

* Mann whitney u test
** One way ANOVA

Mann whitney u test for comparing functional outcome with age, sex, technique, whereas One way ANOVA test used for comparing functional outcome with grade of tumor.

In our study, age, sex had no significant effect on functional outcome whereas grade of tumor, technique had significant effect on functional outcome



Complications
1) Infection-
   (a) Superficial infection
   (b) Deep infection-0
2) Restricted ROM- 4
3) Varus collapse-1
4) Recurrence-1

Superficial infections were managed by proper debridement and antibiotics for 2 weeks as per culture sensitivity reports, four patients had restricted ROM which were improved with regular physiotherapy, one patient had varus collapse seen on radiograph but patient had no complaint functionally and one patient with grade-3 gct had recuurence and adviced for surgery but patient follow-up lost.

4. Discussion

Recurrence is the biggest challenge in the treatment of giant cell tumor of bone. Curettage alone has high recurrence rate of 60%[6], whereas resection either marginal or wide are associated with functional disability. In our study, extended curettage with reconstruction using bone cement or sandwich technique with internal fixation showed lower recurrence rate and good functional outcome. For proper curettage, good exposure by making large cortical window is must. Bony ridges need to be removed with help of high

speed burr. Mode of action of 5% phenol is protein coagulation and necrosis and DNA damaged[7] and has showed less recurrence rate.[8] Bone graft help to maintain joint function and prevention of articular degeneration[9], whereas bone cement destroy the remaining tumor after extended curettage by heating effect.[10] In our study diagnosis was made on the basis of preoperative biopsy in all the cases and intra-operative collected samples were sent for histopathological examination which helps in confirming the diagnosis.

Reconstruction with sandwich technique (chips of cancellous iliac crest graft then layer of gelfoam and rest cavity filled with bone cement after internal fixation. Chips of cancellous iliac crest graft taken as resorption rate is low so less chance of graft collapse seen , graft should always be obtained by using new set of instruments to avoid risk of implantation GCT. We did bone cement in six cases and sandwich technique in nine cases and MSTS score was different with both techniques.. In our study with extended curettage and reconstruction with sandwich technique or bone cement showed recurrence in one patient whereas Kafichitsas et al[11] reported recurrence rate of 52.9% in patients treated with cancellous bone filling or curettage alone and recurrence rate of 23.8% in cases treated with bone cement.

Periosteum on posterior aspect is a biological barrier that prevents escape of bone cement/bone graft from the cavity. Therefore care must be taken to prevent cortical breech/ periosteum from posterior aspect during curettage.[12] Curetted cavity reconstructed with bone cement or (bone cement + bone graft). The advantage of bone cement are thermal and cytotoxic effect to decrease risk of recurrence and immediate weight bearing and disadvantage of bone cement cause degeneration of articular cartilage in subchondral area.[13]In our study GCT treated with extended curettage and reconstruction with bone cement or sandwich technique showed recurrence in one patient with grade-3 gct whereas Vidai et al[14], O'Donell et al[15] reported 25% local recurrence after treatment of 60 GCT patients with curettage and packing with bone cement. The advantage of autogenous graft is permanent reconstruction, incorporated easily and disadvantage donor site morbidity, infection, and difficult to detect reccurence. Using layer of gelfoam and autogenous bone graft helps in protecting articular cartilage from bone cement thermal effect and helps in supporting subchondral bone.

In our study we used cortico-cancellous screws and locking plates for providing stability to bone graft and bone cement and therefore decreases the chances of collapse, which helps in early mobilization and results in better range of motion. One of our case treated with bone cement and cortico-cancellous screws showed varus collapse at one year followup, hence rigid fixation is necessary while addressing larger lesions.

Usually GCT of grade-3 category treated with wide resection to prevent recurrence. Recurrence rate for grade-3 GCT after curettage range from 45-52%.[16-20] T Morri et al[21] (2008), Tain- Hsiung et al[22](2005) found no difference betwwen functional outcome and grading of tumor Thus, reconstruction appears to be good alternative to wide resection, but in our study grade of tumor had significantly affects the functional outcome on application of one way ANOVA test, thus may be attributed to small number of grade-3 cases(3).

Thus the benefits of improved function and less morbidity seen with intralesional curettage , thought to outweigh disadvantage of high local recurrence and re-operation rate than was seen with en bloc resections[22-25]. In our study the mean MSTS score was 25.27 out of 30, whereas Balaji saibaba et al[26] mean MSTS score was 27.7 out of 30 and that of Banerjee, Samik et al[27] found mean MSTS for lower limb was 26 and that of Yogesh panchwagh et al[28] found mean MSTS score at final follow up was 24.59.

In our study, two patients had extensor lag of 10° which improved in both patients with regular physiotherapy, two patients had terminal flexion restriction along with difficulty in squatting which doesnot improved whereas average range of motion around knee joint in our study was 115° and knee joint motion was 122.9° in studies conducted by Banerjee, Samik et al[28].
In our study , 2 patients developed superficial infection at surgical site which was managed with regular dressings and antibiotics in another study by S.P. Gupta et al[29] 3 patients developed superficial infection which was treated by prolong antibiotics.

1(33.3%) case of recurrence out of 3 patients with grade 3 GCT was seen in our study which was treated with extended curettage and bone cement whereas in study conducted by B Saibaba et al[26]. showed 1(6.3%) case out of 16 with grade 3 GCT had recurrence

5. Conclusion

Extended curettage (Intralesional curettage + use of adjuvants) and reconstruction with bone cement or sandwich technique[4] has improved quality of life, good functional outcome, and lower recurrence rate. Patients of different age groups and both gender got benefited equally from treatment in terms of functional outcome. The tumor grading according to Campanacci's[4] grading system and surgery affect the functional outcome in this study. A long follow-up is required to see if these outcomes are good and to see recurrence rates, and large number of patients is required to report if similar results are seen among majority patients.

References

[1] Eckardt JJ, Gorgan TJ. Giant cell tumor of bone. Clin Orthop Relat Res 1986; 204:45-58.
[2] Arbeitsgemeinschaft Knochentumoren, Becker WT, Dohle J, Braun A, Cserhati M, et al. Local recurrence of giant cell tumor of bone after intralesional treatment with and without adjuvant therapy. J Bone Joint Surg Am 2008; 90:106-14.
[3] Campanacci M, Baldini N, Boriani S, Sudanese A. Giant cell tumor of bone. J Bone Joint Surg Am 1987; 69:106-14.
[4] Campanacci M, Capanna R, Fabbri N, Betteli G. Curettage of giant cell tumor of bone. Reconstruction

with subchondral grafts and cement. Chir Organi Mov 1990;75(1suppl):212-3.
[5] Petterson H, Rydholm A, Persson B. Early radiologic detection of local recurrence after curettage and acrylic cementation of giant cell tumors. Eur J Radiol 1986;6:1-4.
[6] Carrasco CH, Murray JA. Giant cell tumors. Orthop Clin North Am 1989; 20:395-405.
[7] Lack W, Lang S, Brand G. Necrotizing effect of phenol on normal tissue and on tumors. A study on postoperative and cadaver specimens. Acta Orthop Scand 1994; 65:351-4.
[8] Durr HR, Maier M, Jansson V, Baur A, Refior HJ. Phenol as an adjuvant for local control in the treatment of giant cell tumor of the bone. Eur J Surg Oncol 1999; 25:610-8.
[9] Chen TH, Su YP, Chen WM. Giant cell tumors of the knee: subchodral bone integrity affects the outcome. Int Orthop 2005;29:30-4.
[10] Ward WG Sr, Li G 3rd. Customized treatment algorithm for giant cell tumor of bone: report of a series. Clin Orthop Relat Res 2002; 397:259-70.
[11] Tain-Hsiung Chen, Yu-Ping Su, Wei-Ming Chen. Giant Cell Tumors of the knee: subchondral bone integrity affects the outcome: International Orthopaedics (SICOT) 2005; 29:30-34.
[12] Pan KL, Chan WH. Curettage and cementation in giant cell tumor of the distal tibia using polypropylene mesh for containment : a case report. Malays Orthop J 2010;4:51-3.
[13] Turcotte RE, Wunder JS, Isler MH, Bell RS, Schachar N, Masri BA, et al. Giant cell tumor of long bone : a canadiaan sarcoma group study. Clin Orthop Relat Res 2002; 397: 248-258.
[14] Mays CJ, Steeg KV, Chowdhry S, Seligson D, Wilhelmi BJ. Wrist joint reconstruction with a vascularized fibula free flap following giant cell tumor excision in the distal radius. Eplasty. 2010 May 22; 10:e38.
[15] Prosser GH, Baloch KG, Tillman RM, Carter SR, Grimer RJ. Does curettage without adjuvant therapy provide low recurrence rates in giant cell tumors of bone? Clin Orthop Relat Res. 2005 Jun; (435):211-8.
[16] Lackman RD, Hosalkar HS, Ogilive CM, Torbert JT, Fox EJ. Intralesional curettage for grades ll and lll giant cell tumors of bone. Clin Orthop Relat Res 2005; 438:123-7.
[17] Rooney RJ, Asirvatham R, Lifeso RM, Ali MA, Parikh S. Giant cell tumor of bone. A surgical approach to grade lll tumors. Int Orthop 1993; 17:87-92.
[18] McDdonald DJ, Sim FH, McLoed RA, Dahlin DC. Giant-cell tumor of bone. J Bone Joint Surg Am 1986; 323:60-4.
[19] Capanna R, Fabbri N, Betteli G. Curettage of giant cell tumor of bone. The effect of surgical technique and adjuvants on local recurrence rate. Chir Organi Mov 1990;75(1 Suppl):206.
[20] Yip KM, Leung PC, Kumta SM. Giant cell tumorof bone. Clin Orthop Relat Res 1996; 323:60-4.
[21] Turcotte RE. Giant cell tumor of bone. Orthop Clin North Am. 2006 Jan , 37(1):35-51.
[22] Balke M, Ahrens H, Streitbuerger A, Koehler G, Winkelmann W, Gosheger G, Hardes J. Treatment options for recurrent giant cell tumors of bone. J Cancer Res Clin Oncol. 2009 Jan; 135(1):149-58.
[23] Blackley HR, Wunder JS, Davis AM, White LM, Kandel R, Bell RS. Treatment of giant-cell tumors of long bones with curettage and bone grafting. J Bone Join Surg Am. 1999 Jun;81(6):811-20.
[24] O'Donnell RJ, Springfield DS, Motwani HK, Ready JE, Gebhardt MC, Mankin HJ. Morii T, Yabe H, Morioka H, Suzuki Y, Anazawa U, Toyama Y. Curettage and allograft reconstruction for giant cell tumors. J Orthop Surg(Hong Kong).2008 Apr;16(1):75-9.
[25] Donati D, Wafa H, Di Bella C, Colangeli S, Bertoni F. Management of pelvic giant cell tumors involving the acetabular bone. Acta Orthop Belg. 2008 Dec; 74(6):773-8.
[26] Balaji Saibaba, Devendra Kumar Chouhan, Vishal Kumar, Mandeep Singh Dhillon, Sreekanth Reddy Rajoli. Curettage and reconstruction by the sandwich technique for giant cell tumors around the knee. Journal of Orthopaedic Surgery. 2014; 22(3): 351-5.
[27] Samik Banerjee. Sandwich reconstruction technique for subchondral giant cell tumors around the knee, Current Orthopaedic Practice. 23(5): 459-466.
[28] Yogesh Panchwagh, Pankush Arora, Suheil Khan, Ashok Shyam K, Parag Sancheti. Extended Curettage and reconstruction with bone grafting or combined bone graft and cement (Sandwich Technique) in giant cell tumors (GCT) of bone – Prospective study of Functional Outcome: Journal of Orthopaedics and Rehabilitation. 2011; 1(1):55-60.
[29] Som Gupta P, Gaurav Garg. Curettage with cement augmentation of large bone defects in giant cell tumors with pathological fractures in lower-extremity of long bones. Journal of Orthopaedics and Traumatology.2016;17(3):239-247.

Cases 1

Figure 1: Post – operative X Ray of GCT of proximal tibia treated with bone cement and cortico-cancellous screws showing varus collapse

Case 2

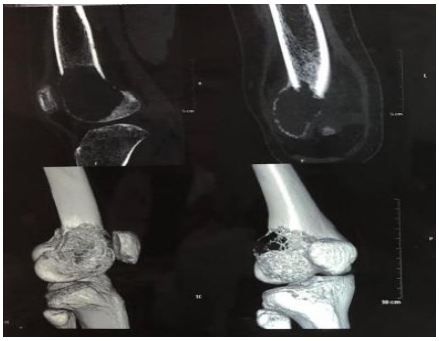


Figure 5: CT Scan showing GCT of distal femur

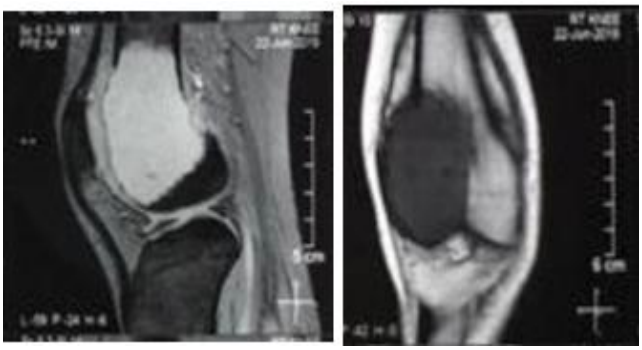


Figure 6: MRI scans showing gct in distal femur in both sagittal and coronal cuts

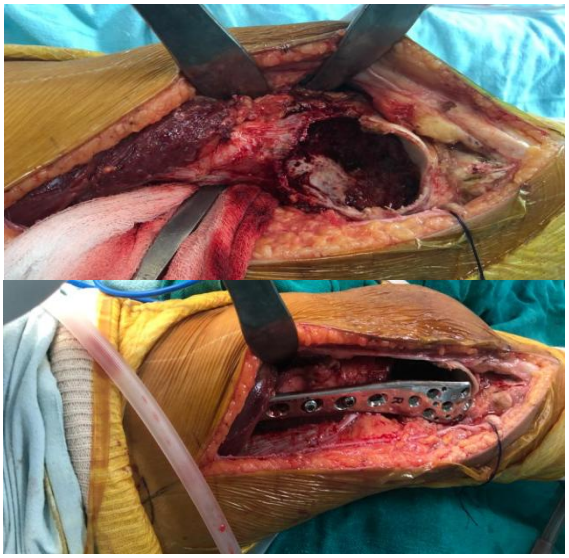


Figure 7: Showing sandwich technique (intra-operative)

Figure 9: X ray at 12 months follow-up of GCT of distal femur treated with sandwich technique

Figure 11: Showing patients at final follow-up operated for (a) GCT proximal tibia with limitation of terminal flexion, (b) gct distal femur with no liamitation of flexion.

Case 3: Recurrence of GCT

Figure 12: Showing Swelling around Knee Joint Proximal tibia GCT

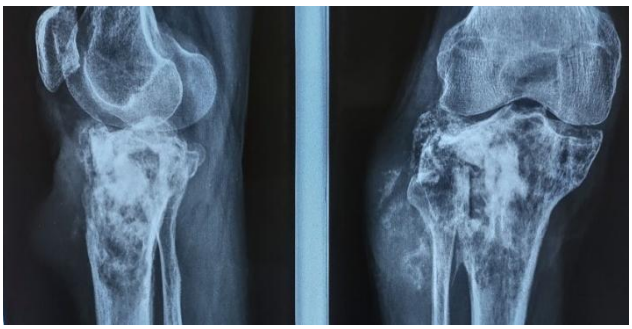


Figure 13: Digital Radiograph AP and LAT view showing local recurrence of GCT of proximal tibia after 4 years